**SPECIFICATIONS FOR**

**SCOTT JENKINS PARK**

**DIVISION 26 – ELECTRICAL**

## 1 GENERAL CONDITIONS:

Work under this division is subject to the general conditions herein before written for the entire work insofar as they apply to this work. The Contractor shall carefully examine these and all applicable contract drawings, and he shall assume all obligations contained therein that affect the work.

## 2 SCOPE OF WORK:

Work under this division covers all electrical work for the construction of the project except site work. Actual work shall be as detailed elsewhere herein and on the drawings.

A. Provide and install service entrance panelboards, metering equipment, disconnect switches, and circuit breakers as shown on the drawings.

B. Provide and install parking lot lighting, pole mounted fixtures and poles as shown on the drawings.

C. Provide and install Electric Vehicle Charging Stations and system as shown on the drawings.

D. Provide and install Solar Photovoltaic system as shown on the drawings.

E. Provide and install all electric miscellaneous devices and branch circuits as shown on the drawings.

## 3 APPLICABLE SPECIFICATIONS, CODES, STANDARDS AND PERMITS:

A. Unless otherwise specified herein or shown on the contract drawings the work and materials shall conform to the applicable requirements of the codes, standards, and regulations issued by the following:

| | |
|---|---|
| VA | Virginia Uniform Statewide Building Code |
| LC | Loudoun County |
| ANSI | American National Standards Institute |
| EIA | Electronic Industries Association |
| ETL | ETL Testing Laboratories |
| ICC | International Code Council |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| NTSC | National Television Systems Committee |
| OSHA | Occupational Safety and Health Administration |
| UL | Underwriters Laboratories |

B. All equipment shall be installed in accordance with Manufacturer's recommendations and instructions.

C. This Contractor shall apply for, obtain and pay for all required permits and inspections certificates.

**4 EQUIPMENT DEVIATIONS:**

A. Where the Electrical Contractor requests approval of an item of equipment which deviates from the requirements of the specifications or the drawings and will require a redesign of structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or Architectural layout, all such redesign, and all new drawings and detailing required therefore, shall be prepared and paid for by this Contractor and submitted to the Owner for his approval.

B. Where specific items of a particular manufacturer are specified herein by make or model number it is not the intent of these specifications to prohibit the use of technically equivalent items of another manufacturer provided all requirements herein are met including those requirements which are inferred by specifying the particular item described. Should the contractor wish to propose alternate items to those specified, approval of the Owner must be obtained prior to installation.

**5 MATERIALS:**

A. Unless otherwise shown on the contract drawings or specified herein, each item of equipment furnished by this Contractor shall be the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, they shall be the product of a single manufacturer.

B. For equipment consisting of an assembly of multiple components, such multiple components do not have to be the products of a single manufacturer.

C. The Contractor shall submit to the Owner, for approval, lists of material together with descriptive literature, manufacturer's identity, wiring diagrams, controls, parts lists, and statements of compliance for all items so indicated in the Sections of this Division.

**6 BUILDING CONSTRUCTION:**

A. Refer to the general construction drawings, which are bound with the drawings of the work, for construction details.

B. The electric service characteristics are 120/240V, single phase, 60 Hertz.

**7 INSPECTION OF SITE:**

Each bidder shall be held to have thoroughly inspected the site.

**8 TEMPORARY FACILITIES:**

As specified under General Conditions and Supplementary General Conditions and Division 1.

**9 INSTALLATION OF WORK:**

A. Examine the site and all drawings before proceeding with the layout and installation of the work. The Contractor is responsible for ascertaining the

existing conditions, locations, runs, sizes, materials, slopes, etc. of all mechanical, electrical and plumbing systems existing at the time of this Contractor's work that will need to be modified, moved, connected into or otherwise affected by work under this section and for developing details as required to suit. Any discovered condition which requires a change to the design prescribed by these specifications or the drawings shall be submitted to the Owner for approval.

B. Arrange the work essentially as shown; exact layout to be made on the job to suit actual conditions. Confer and cooperate with other trades on the job so all work will be installed in proper relationship. Precise location of parts to coordinate with other work is the responsibility of the Contractor.

C. Arrange for required chases, slots and openings. Contractor is liable for cutting or patching made necessary by his failure to make proper arrangements in this respect. The Electrical Contractor shall perform all cutting and patching for electrical work including core drilling through floors and walls.

D. Make electrical connections to all electrical equipment furnished by others or relocated as shown on the drawings. Follow equipment manufacturers' detailed instructions and recommendations in the installation and connection of all equipment. In case of conflict between manufacturers' instructions and the contract documents, notify the Owner before proceeding. No equipment installation or connections shall be made in a manner that voids the manufacturer's warranty.

E. Install all work in a neat and workmanlike manner, using only workers thoroughly qualified in the trade or duties they are to perform. Rough work will be rejected.

F. Provide a full time superintendent who shall oversee and coordinate the work with the other trades, receive instruction from the Owner, and make proper layout of the work to suit job conditions and to satisfy the general requirements of the contract.

G. Clean up work and leave ready for use or for painter's finish as required. Remove all dirt and rubbish from the premises daily.

H. Coordinate service entrance installations and connections with the serving utility.

**10 PERFORMANCE DATA:**

All performance data specified herein shall be considered actual performance of equipment as installed. If installation details are such that actual operating conditions unfavorably affect performance as compared to conditions under which the equipment was rated, suitable allowance shall be made by the Contractor.

## 11 EQUIPMENT SUPPLIER INSPECTION:

The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has made on the job inspection of the installation and has certified that the equipment is properly installed and that preliminary instructions have been given and this equipment is ready for operation.

Service entrance equipment
Panelboards

## 12 DRAWINGS AND SPECIFICATIONS

A. It is the intention of these drawings, specifications and conditions to fully cover all required work and apparatus not specifically excepted for all electrical work, including all equipment and installation as indicated on the drawings and specified hereinafter. The project when turned over to the owner will be complete and in first-class "turn- key" condition for the purpose intended.

B. Location of electrical outlets, switches, receptacles, lighting fixtures, and other items shown on the drawings is approximate unless indicated otherwise. Exact locations shall be determined on the job but shall comply with all requirements shown on the drawings including Architectural, structural, mechanical, and civil drawings. For major pieces of equipment, shop drawings showing locations shall be submitted for approval prior to installation.

C. Throughout the work the Contractor shall record on one set of drawings all details and changes made in performing the work. At the completion of the job the Contractor shall submit to the Owner this set of record drawings showing the work as actually performed.

## 13 PROTECTION OF EQUIPMENT

All materials and equipment furnished under this section of the specifications while being installed and before acceptance by the owner shall be protected so that no ill usage of it can be done by workers or others on the premises. All new material and equipment shall be in new condition at acceptance of work. The Contractor shall be held responsible for the conditions of materials and equipment until acceptance by the Owner.

## 14 PERSONNEL INSTRUCTION AND OPERATING INSTRUCTIONS

A. Furnish to the Owner for delivery to the Owner sufficient copies of an approved operations and maintenance instruction booklet along with a copy of the submittal data for each new item of equipment installed under this section.

B. After all tests are conducted and approved as specified below, furnish a competent operating engineer for a period of one day to instruct and

demonstrate to the Owner, or his authorized representative, the operation of the system. Notify the Owner in writing of person to whom this instruction was given and the date given.

## 15 TESTS

A. The Contractor shall conduct all tests required by local authorities and all other regulatory agencies. The Contractor shall notify proper authorities prior to conduct of tests where required. Prior to conducting the tests the Contractor shall submit test plans and procedures to the Owner for approval. The Contractor shall furnish all instruments and test equipment.

B. Test all wiring and connections for continuity and grounds before the fixtures are connected and, when directed, demonstrate by "megger" (1 megohm minimum resistance) test the insulation resistance of any circuit or group of circuits. When such insulation resistance test indicates the possibility of faulty insulation, locate the point of such fault, replace the conductor, and retest to show satisfactory resistance.

C. After all systems are completely tested, submit three (3) copies of the test results to the Owner for approval. Final inspection will not be made until test results are approved.

## 16 CONTRACTOR'S WARRANTY

A. Contractor shall warrant the workmanship, all materials, and equipment against defects, leaks, or non- operation for a period of one (1) year from the date of substantial completion.

B. The warranty shall not obligate the Contractor to repair damage resulting from accident or improper operation or care on the part of the Owner provided such damage is not due to defective material or installation.

C. Defects becoming apparent within the warranty period shall be repaired by the Contractor as directed by the Owner.

**END OF SECTION 260000**

**260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SCOPE OF WORK

A. This Section includes building wire and cable and associated splices, connectors, and terminations for wiring rated 600 volts or less and grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems.

1.03 SUBMITTALS

A. Post-construction field tests and observations noted shall be submitted to the Engineer.

B. Cable pulling procedures for wires and cables

C. Conductor splicing detail

D. Manufacturer’s Product Data on the following

1. Conductor s

2. Grounding Equipment

E. Grounding Resistance Test Report

F. Branch Circuit amperage and voltage measurement report

1.04 ABBREVIATIONS

A. Abbreviations are as follows:

1. ANSI - American National Standards Institute

2. NEMA - National Electrical Manufacturers Association

3. NFPA – National Fire Protection Agency

4. NECA – National Electrical Contractors Association
5. NEC - National Electrical Code
6. UL - Underwriters Laboratory

## PART 2 - PRODUCTS

### 2.01 STANDARDS

A. Conductors, wiring and grounding shall comply to the following standards:
   1. NFPA 70 "National Electrical Code" for components and installation and NFPA 780.
   2. UL 467.

B. UL Compliance: Provide products which are UL-classified and labeled for the location and environment in which they are installed.

### 2.02 CONDUCTORS

A. All feeder circuit conductors shall be stranded copper 600-volt with THWN-2 insulation rated at 90 degrees C.

B. Secondary Service Conductors: Shall meet requirements of local electrical utility.

C. Equipment Grounding Conductors: Insulated with green color insulation.

D. Grounding-Electrode Conductors: Stranded copper.

E. Underground Grounding Conductors: Bare, tinned, stranded, except as otherwise indicated.

### 2.03 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

B. Grounding Rods: Copper-clad steel.

C. Size: 3/4”-inch diameter x 10-foot-long.

D. Ground Clamps: Bolted heavy-duty type.

## 2.04 CONNECTORS AND SPLICES

A. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

## 2.05 CONDUCTOR TAGS AND LABELLING

A. Sleeve-type labels shall be used at all conductor terminations and splices in pole handholes. Labels shall indicate panel designation and circuit.

B. Conductor tags shall be used in all pull boxes, cabinets, and handholes. Conductor tags shall be T&B TY553M or equal. Tags shall be marked with a marker with black indelible ink.

C. All tags and labels shall be waterproof.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine raceway to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.02 CONDUCTOR INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation".

B. The Contractor shall develop a detailed cable pulling procedure for installing conductors in the conduit. This procedure shall define the allowed conductor pulling tensions and sidewall pressures as allowed by the conductor and conduit vendor. The procedure shall include conductor-pulling calculations certified by a Professional Engineer. The procedure shall detail the equipment and instruments to be used for the conductor pulling. The procedure shall be submitted to the Owner for approval prior to the installation of any conductors.

C. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.

1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conduit and conductors or insulation.

2. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Neatly train and lace wiring inside boxes, equipment, and panel boards.

## 3.03 WIRING CONNECTIONS AND TERMINATIONS

A. Conductor Splices: Conductor splices shall be avoided. Where required, they shall be made in pole handholes or in pullboxes. All splices made below grade, whether in raceway or not shall be considered to be in a wet location in accordance with the NEC (NEC 110.14(B) and all such splices shall be made using materials and techniques that are UL listed for wet locations.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Terminate spare conductors with solder-less pressure connectors and electrical tape.

E. Tighten screws and bolts according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

F. Group, bundle and tag set of conductor circuits in pull boxes, pole handholes and the lighting control cabinet output terminal block. Tags shall indicate the type of circuits (Sports lighting, Security Lighting, etc), the panel circuit numbers and the pole number. Tags shall be waterproof and shall be sized to allow for ease of reading labeling as indicated above. Tags shall attach around conductors with tie-wraps.

## 3.04 GROUNDING

A. Ground electrical systems and equipment according to NEC requirements and local regulations, except where Drawings or Specifications exceed NEC requirements.

B. Equipment Grounding Conductors shall comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways.

2. Connections to Lightning Protection System: Bond grounding conductors, including grounding-conductor conduits, to lightning

protection down conductors or lightning protection grounding conductors in compliance with NFPA 780.

C. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.

D. Drive rods until tops are 24 inches below final grade, except as otherwise indicated.

E. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

F. Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

G. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

## 3.05 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Torque test conductor connections and terminations to manufacturer's recommended values.

C. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

## 3.06 COLOR CODING

A. Insulation of conductor sizes #8 AWG and smaller shall be colored. Conductor sizes of #6 AWG and larger may be colored with plastic tape or sleeves of the appropriate color at all junction boxes and terminations that comprise the circuit. Wiring shall conform to the following color codes:

1. Color coding for single-phase (120/240v) system shall be:

a) A Phase Black

b) B Phase Red

c) Neutral White

d) Ground Green

3.07 TESTING

A. Upon completion of wiring and installation of equipment, the contractor shall measure and record the amperage and voltage of each branch circuit at the breaker in the cabinet on each sports lighting pole and at the breakers in the lighting control cabinet.

B. The contractor shall measure and record resistance to ground at the main breaker as noted under 3.04B above.

**END OF SECTION 260519**

## PART 4 - GENERAL

### 4.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

### 4.02 SCOPE OF WORK

A. This Section includes underground conduits and pull boxes (handholes) including trenching and backfilling.

### 4.03 ABBREVIATIONS

A. Abbreviations are as follows:

1. ANSI - American National Standards Institute
2. NEC - National Electrical Code
3. UL - Underwriters Laboratory
4. NEMA - National Electrical Manufacturers Association
5. ASTM – American Society for Testing and Materials
6. NFPA – National Fire Protection Agency
7. SCTE - Society of Cable Telecommunications Engineers

### 4.04 SUBMITTALS

A. The Contractor shall submit conduit and box manufacturer, model numbers and product data sheets to the Engineer prior to construction.

### 4.05 SAFETY REQUIREMENTS

A. Perform work in accordance with the safety requirements of the Department of Labor Occupational Safety and Health Administration, Volume 36, Number 75, Part II, Subpart P, "Excavations, Trenching, and Shoring," and with Section 7 of the Manual of Accident Prevention in Construction as published by the Association General Contractors of America, Inc.

B. Comply with federal, state, and local safety codes and regulations. Educate supervisors and employees on safety requirements and practices to be followed during the course of the work.

## PART 5 - PRODUCTS

### 5.01 STANDARDS

A. Products shall comply with the following standards:

1. Comply with NFPA 70 "National Electrical Code" and ANSI C2 "National Electrical Safety Code" for components and installation.

2. UL Compliance: Provide product(s) which are UL-classified and labeled for the location and environment in which they are installed.

### 5.02 MANUFACTURERS

A. Available Manufactures: Subject to compliance with requirements, that may be incorporated in the Work include the following products:

1. PVC Conduit – Products of all manufacturers are acceptable as long as the products are sunlight resistant and labeled for the application. Products from manufacturers making both the conduit and the fittings are preferred whenever possible.

2. Rigid Metal Conduit - Products of all manufacturers are acceptable as long as the product is hot dipped galvanized steel inside and out, have a smooth interior, and are labeled for the application.

3. Pull Boxes – Quazite or any other manufacturer which meets the requirements of these specifications.

### 5.03 CONDUIT AND DUCT

A. Conduit materials shall be as detailed on the drawings.

B. Metallic Conduit: Use above ground only. Transition from PVC to Metallic conduit shall be made at grade with a suitable threaded connector and PVC to steel conduit adaptor.

1. Rigid Metal Conduit (RMC): ANSI C80.1, galvanized.

C. Non Metallic (RPVC) Conduit: Use below ground only.

1. Rigid Plastic Conduit: NEMA TC 2 and UL Listed, Schedule 40 PVC, rated for use with 90°C conductors under all installation conditions.

2. PVC Conduit and Tubing Fittings: NEMA TC 3 and UL Listed.

3. Solvent and Primer: Use product specifically designed for RPVC conduit

D. All underground conduits shall be a minimum of two-inch standard trade size unless otherwise noted.

## 5.04 PULL BOXES

A. The Contractor shall provide all in-ground pull boxes (handholes) where required to connect conduits and where specifically noted.

B. Pull Boxes and lids may be made from composite material or reinforced concrete and shall meet the following requirements:

1. Shall meet the requirements of *NEC 314.30 – Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Manholes: Handhole Enclosures.*

*2.* Shall meet the requirements of ANSI/SCTE 77-2002 and have static *Tier 15 Rating.*

3. Sizes shall be as follows:

a) Small pull box - Minimum 17 inches x 30 inches x 18 inches deep.

b) Large pull box - Minimum 30 inches x 48 inches x 24 inches deep.

4. Lids shall be labeled “electrical”, bolt down to the box and have a non-slip surface.

5. Steel lids shall be galvanized and bonded.

C. All removable covers or openings on pull boxes and handholes shall be secured with stainless steel threaded fasteners of an approved tamper resistant design. The Contractor shall supply two sets of all sizes of special tools needed for these fasteners and provide them securely mounted in one of the electric equipment enclosures and suitably marked as to their purpose. In addition, the Contractor shall supply 10% spare fasteners of all sizes.

## PART 6 - EXECUTION

### 6.01 EXAMINATION

A. Examine site to receive ducts for compliance with installation tolerances and other conditions affecting performance of the underground ducts. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 6.02 EARTHWORK

A. Trenching:

1. Excavation is unclassified soil and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions.
2. Depth: Excavate to bottom elevation of conduit and correct points of over excavation by returning trench to grade with mechanically compacted backfill to form a smooth trench bottom. Provide a minimum 24 inches of cover over the top of the conduits.
3. Width: Excavate to minimum width consistent with stability of sides.
4. Muck Excavation: Where muck or unstable material determined by frost condition is encountered, over excavate as required and backfill to attain proper grade with coarse sand, gravel, or other slurry.
5. Rock Excavations: Where rock pad is used for conduit trench, over excavate six inches below the conduit, and refill and compact with selected backfill material of same composition.
6. Materials suitable for backfilling to be piled in an orderly manner.
7. Bedding: The entire bottom of the excavation is to be firm, stable, and at a uniform density. Remove rocks larger than 2 inches in diameter.

B. Asphalt and Concrete:

1. Areas of trenching in concrete or asphalt shall be done to the minimum width possible to reduce impacts. Asphalt or concrete shall be neatly saw-cut in straight line, removed and disposed of off-site. Temporary backfill will be required if the restoration does not take place during the same day. Asphalt shall be hot mix type fully compacted.

C. Backfilling:

1. Backfill only after all necessary inspections and tests are performed and are in conformance with the requirements specified.

2. Backfill with native material unless deemed unacceptable by the Engineer. Remove all debris, rocks, broken concrete, formwork, etc. from the trench prior to the start of backfilling operations.

3. Deposit backfill in 6 inch lifts and compact to 98 percent standard proctor density

4. If trenches have not been properly filled, or if settlement occurs, refill, compact, smooth off, and make to conform to the surface of the ground.

## 6.03 CONDUIT AND DUCT INSTALLATION

A. Install nonmetallic conduit and duct as indicated according to manufacturer's written instructions.

B. Curves and Bends: Use manufactured elbows for stub-ups in poles, concrete bases and pull boxes. Use non-manufactured long sweep bends with a minimum radius of 25 feet both horizontally and vertically at other locations. Do not exceed 20 degrees for field bends.

C. Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Cap all empty conduits.

E. After installation and prior to installing pull string: Pull a brush through the full length of ducts. Use round bristle brush with a diameter 1/2 inch greater than internal diameter of duct.

F. Pulling Cord: Install 100-pound-test nylon cord in ducts, including spares.

## 6.04 PULL BOXES

A. Pull boxes shall be installed as shown on the drawings or as needed for conduit pulling. Boxes with steel lids shall be grounded.

## 6.05 RESTORATION

A. Restore surface features at areas disturbed by excavation, and reestablish original grades except as otherwise indicated. Replace removed sod as soon as possible after backfilling is completed (same day). Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoil, fertilizing, liming, sodding, and mulching. Soil restoration details shall be discussed with and agreed upon by the Owner in advance of restoration activities.

B. Restore disturbed paving or concrete to original condition or better.

**END OF SECTION 260543**

**262400**
**SWITCHBOARDS AND**
**PANELBOARDS**

## 1 GENERAL

The General Conditions and Supplementary Special Conditions of Division 1 and the General Provisions of Division 26 shall apply to all work under this Section of the specifications.

## 2 SCOPE

Provide all labor, materials, equipment, and services and perform all operations required for the complete installation of all panelboards and related work as shown on the drawings and as specified herein.

## 3 MATERIALS

A. Service entrance panels and service disconnects shall be as shown on the drawings.

## 4 EXECUTION

A. All panelboards shall be located at the locations as shown on the drawings.

B. All panelboards shall be installed plumb and level and shall be fitted tightly to the wall surface.

## 5 SUBMISSION

Provide 6 copies of manufacturer's catalog cuts or shop drawings for the items listed below. Submittals shall include unit construction and ratings and shall include any recommendations by the installer or manufacturer. Submissions shall show that all units conform to the requirements herein.

Service entrance panels
Service disconnect device
Panelboards and main circuit breakers
Branch circuit breakers

**END OF SECTION 262400**

# PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions shall, apply to this Section.

## 1.02 SCOPE OF WORK

A. This specification shall apply to the design and supply of the pad mounted, weatherproof, electric equipment enclosures that are used to house electric equipment.

B. The electric equipment enclosures shall be as noted on the contract drawings.

## 1.03 ABBREVIATIONS

A. Abbreviations are as follows:

1. ANSI - American National Standards Institute
2. NEMA - National Electrical Manufacturers Association
3. NEC - National Electrical Code
4. UL - Underwriters Laboratory

## 1.04 SUBMITTALS

A. Submit the following information for Engineer review prior to construction:

1. Detailed cabinet and door shop drawings showing all fabrication and the layout of all internal components.
2. List of all components (by manufacturer and model number) and product sheets for each item.

## PART 2 - PRODUCTS

### 2.01 STANDARDS

A. The final cabinet shall bear the label of the UL or other listing agency.

B. The supplier shall design and produce the electric equipment enclosures to meet the criteria noted in this document. The supplier shall be capable of producing a premium grade product, which meets the quality, fit and finish noted in this document.

C. The cabinet shall be designed to meet the approval of the local electrical utility and shall be designed for easy maintenance.

D. All equipment produced shall meet the requirements of the NEC.

### 2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, that may be incorporated in the work include the following products:

1. Hoffman
2. NJ Sullivan Co.
3. Or equal.

### 2.03 QUALITY CONTROL

A. The supplier shall have and maintain a suitable quality control program throughout the contract. The purpose of the quality control program is to ensure that the product meets the quality requirements of these qualifications, is delivered on time, and is produced in a cost-effective manner. The supplier’s quality control program shall apply to all stages of the design, procurement, manufacturing, testing and delivery of the product.

### 2.04 GENERAL MATERIAL REQUIREMENTS

A. All materials shall be new.

B. Unless otherwise noted, the cabinet shall be fabricated from galvanized post-fabrication, electrostatically primed and painted steel minimum 14 gauge (0.0785 inch thick). See paragraph 2.11 Finishes.

C. All materials shall be corrosion resistant for extended life

D. Enclosures shall be rated NEMA 3R or 4X.

## 2.05 FABRICATION PROCESS

A. The cabinet and doors shall be fabricated to plus or minus 10-thousandths of an inch tolerance for proper fit.

B. All bending shall be done using a suitable break press.

## 2.06 CONNECTING HARDWARE

A. All screws, bolts, washers, nuts, etc. shall be stainless steel.

B. All screws shall be stainless steel pan-head machine screw type.

C. No sheet metal or self tapping screws shall be used.

## 2.07 WELDING

A. All exterior seams shall be of continuously welded construction. All welds shall be free of slag and spatter. All exterior welds shall be ground smooth.

B. The supplier shall have suitable credentials to weld steel and shall adhere to all applicable ANSI standards.

C. The supplier shall use a suitable welding process and materials.

## 2.08 DOORS AND HINGES

A. Doors shall be designed for maximum strength and snug fit. It is the supplier's responsibility to design and fabricate the doors to the fit and finish required in this specification.

B. Doors shall be fabricated out of a single sheet of steel and have wrap-around return for strength and fit.

C. Doors shall be fully gasketted against the cabinet.

D. Door handles shall be 3-point contact steel construction. The lever handles shall latch to the cabinet 16-gauge stainless steel rails and rollers which shall be fabricated to provide a secure and well sealed attachment to the cabinet. Door handles shall be designed to accept a padlock. Bolted door closures or dogs are not allowed.

E. The exterior of the doors shall have continuous welds.

F. All exterior corners shall be rounded to a minimum radius of 1/8 of an inch. All sharp edges shall be de-burred to a minimum radius of 1/64 inch in order to reduce hazards to service personnel.

G. Hinges shall be both corrosion resistant and vandal proof.

## 2.09 CABINET

A. The cabinet and door shall be constructed to meet NEMA 3R or 4X standards. The cabinet shall be made up of the main body, roof section and inner wall. These components shall be welded together. The cabinet shall be designed for maximum strength and proper fit to the door.

B. It is the supplier's responsibility to design and fabricate the cabinet to the fit and finish required in this specification.

C. The cabinet shall be designed to attach to concrete pad via suitable drop-in anchors, which shall be supplied with the cabinet.

D. The exterior of the cabinet shall have continuous welds.

E. The cabinet main body shall have a wrap-around return to accept the door.

F. The cabinet shall have 120V spec grade ground fault duplex receptacle and interior lighting as shown on the drawings. If required, the cabinet shall have ventilation fan(s) and heater to provide ambient temperature control for enclosed equipment. The rating of the fans and heater will be based on the enclosed equipment and as required by the equipment manufacturer. Heater and fan shall be controlled with an electronic thermostat.

G. The cabinet shall be equipped with lifting brackets, which shall be removable after the installation.

H. All exterior corners shall be rounded to a minimum radius of 1/8 of an inch. All sharp edges shall be de-burred to a minimum radius of 1/64 inch in order to reduce hazards to service personnel.

## 2.10 EQUIPMENT MOUNTING INNER WALL

A. Equipment shall be mounted on the interior using mounts and fittings supplied with the enclosure. No penetrations of the outer enclosure shall be used to mount equipment.

B. Equipment mounting panels shall be constructed from galvanized sheet steel, minimum least 14 gauge.

## 2.11 FINISH

A. Upon completion of fabrication the cabinet, door and inner wall shall be finished as follows:

1. The surface shall be thoroughly cleaned and degreased.
2. The surfaces shall receive a prime coat electrostatically applied.

3. After the prime coat has set, the top coat shall be electrostatically applied. Color shall be RAL 6000 “Patina Green” or other color as approved by the Owner.
4. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

## 2.12 GENERAL ELECTRICAL

A. The supplier shall provide equipment layout details with the shop drawings.

B. All equipment shall be mounted on stand-off back panels.

C. All equipment shall be labeled using Lamicoid or vinyl adhesive labels with ½-inch high black characters on a white background.

## 2.13 METERING

A. Metering location shall meet the approval of the local utility company. The metering shall be located for easy reading by the local utility.

B. CT’s and metering cabinets shall be sized and laid out to meet the local utility company’s standards.

## 2.14 GROUNDING

A. The grounding system shall be designed to meet all NEC standards and any codes and local utility standards.

B. The grounding system shall be designed as part of the power distribution system.

## 2.15 LABELING

A. All products shall be labeled (inside) with the supplier’s company name, model number, panel rating and the date of manufacture.

B. The supplier shall also provide adhesive Lamicoid or vinyl labels on the inside of each cabinet for each component. Each contactor and output circuit shall also be labeled in accordance with the suppliers lighting design.

C. All ID labels shall have ¼” to ½” high black characters on a white background.

2.16 PACKAGING

A. Any product damaged in shipping shall be repaired or replaced at no cost to the owner.

PART 3 - EXECUTION

3.01 FOUNDATIONS

A. The contractor shall provide and install concrete pads for electrical equipment enclosures and utility transformers as shown on the drawings. Utility transformer pads shall be supplied and installed with grounding as per utility standards and requirements and shall meet utility approval. Concrete foundations for electrical equipment enclosures shall be as follows:

a) Minimum compressive strength at 28 days – 3500PSI

b) Maximum nominal aggregate size – 1 inch

c) Maximum W/C ratio by mass - 0.45

d) Air content - 5 ± 1%

e) Slump - 2” ± 0.75”

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8 inch in depth as measured across the widest surface.

3. All concrete shall be fully vibrated

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

B. Excavated material may be used as backfill. All excess excavated material shall be disposed of off-site.

3.02 GROUNDING

A. Install all grounding and bonding in accordance with Section 260519 and the contract drawings.

3.03 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged components.

B. Any paint damage shall be repaired by spray applied or other application that matches the factory finish to the maximum extent possible. Brush or roller applied repair painting is not allowed.

**END OF SECTION 262716**

# 262720 ELECTRIC VEHICLE CHARGING STATIONS AND ACCESSORIES

## 1 GENERAL

The General Conditions and Supplementary Special Conditions of Division 1 and the General Provisions of Division 26 shall apply to all work under this Section of the specifications.

## 2 SCOPE

Provide all labor, materials, equipment, and services and perform all operations required for the complete installation of all devices and related work as shown on the drawings and as specified herein.

The equipment and accessories covered by this section are Electric Vehicle (EV) Charging Stations (EVCS) that can be used by consumers for charging a Battery Electric Vehicle (BEV) or a Plug-in Hybrid Electric Vehicle (PHEV).

## 3 APPLICABLE SPECIFICATIONS, CODES, STANDARDS AND PERMITS:

A. Unless otherwise specified herein or shown on the contract drawings the work and materials shall conform to the applicable requirements of the codes, standards, and regulations issued by the following:

| | |
|---|---|
| SAE | Society of Automotive Engineers |
| EPRI | Electric Power Research Institute |
| NEC | National Electrical Code Section 625 |

## 4 MATERIALS

A. Electric Vehicle (EV) Charging Stations (EVCS) shall be pole mounted or standalone ground mounted. EVCS shall be designed for outdoor, unprotected, installation.

B. EVCS shall as a minimum provide charging in accordance with EPRI Level 2 (240-volt) charging using connectors in accordance with SAE Standard J1772. EVCS may provide both EPRI Level 1 and Level II charging. Level 1 charging connector shall be NEMA 5-15R of 5-20R configuration.

C. EVCS shall provide for payment for electricity purchased using a point-of-sale (POS) system that accepts various means of payment such as credit cards, debit cards, smart cards, Radio-Frequency Identification (RFID) fobs, or other technologies to be proposed.

D. Point-of-sale data communication from EVCS stations to a central interface on the property containing the EVCS stations shall be wireless. Point-of-sale data communication from the central interface to a remote accounting system shall be wireless such as by cellular telephone or other technologies. All parts of the POS system shall be included with the EVCS system.

E. All equipment of EVCS stations shall be in accordance with NEC Section 625.

## 5 EXECUTION

A. All devices shall be as shown on the drawings.

B. All devices shall be installed plumb and level.

C. All installation of EVCS stations shall be in accordance with NEC Section 625.

## 6 SUBMISSION

Provide 6 copies of manufacturer's catalog cuts or shop drawings for the items listed below. Submittals shall include unit construction and ratings and shall include any recommendations by the installer or manufacturer. Submissions shall show that all units conform to the requirements herein.

Electric Vehicle Charging Stations
Point-of-sale equipment and system

**END OF SECTION 262720**

## 7 GENERAL

The General Conditions and Supplementary Special Conditions of Division 1 and the General Provisions of Division 26 shall apply to all work under this Section of the specifications.

## 8 SCOPE

Provide all labor, materials, equipment, and services and perform all operations required for the complete installation of all devices and related work as shown on the drawings and as specified herein.

## 9 MATERIALS

A. Switches shall be rated at 15 amps at 120 volts and shall have side-wired binding screw type terminals and straight through yolk. Switches shall not require derating for lamp loads and shall be approved for motors up to 80 percent of switch rating. Switches shall be quiet AC type. Switch toggles and switch wall plates shall be of color as selected by the Owner.

B. Indoor wall receptacles shall be duplex, located and grouped as shown on the drawings with minimum rating of 15 amps at 120 volts. Receptacles shall be side wired binding screw type terminals. Receptacles and wall plates shall be of color as selected by the Owner.

C. Disconnects and safety switches shall be as shown on the drawings.

## 10 EXECUTION

A. All devices shall be located at the heights shown on the drawings.

B. All devices shall be installed plumb and level and shall have cover plates fitted tightly to the mounting surface. The floor boxes, covers, and trim shall be adjusted to suit the finish floor material.

## 11 SUBMISSION

Provide 6 copies of manufacturer's catalog cuts or shop drawings for the items listed below. Submittals shall include unit construction and ratings and shall include any recommendations by the installer or manufacturer. Submissions shall show that all units conform to the requirements herein.

Switches
Receptacles
Safety switches and disconnects

**END OF SECTION 262726**

# 263100 SOLAR PHOTOVOLTAIC COLLECTORS AND ACCESSORIES

## 1 GENERAL

The General Conditions and Supplementary Special Conditions of Division 1 and the General Provisions of Division 26 shall apply to all work under this Section of the specifications.

## 2 SCOPE

Provide all labor, materials, equipment, and services and perform all operations required for the complete installation of a solar photovoltaic (PV) grid-tied power system of 25 kilowatts or less as shown on the drawings and as specified herein.

## 3 APPLICABLE SPECIFICATIONS, CODES, STANDARDS AND PERMITS:

A. Unless otherwise specified herein or shown on the contract drawings the work and materials shall conform to the applicable requirements of the codes, standards, and regulations issued by the following:
NEC National Electrical Code Section 690

## 4 MATERIALS

A. General:

1) All systems should be designed for outdoor installation in Climate Zone 4. Annual ambient temperatures can range from 0° F to 100° F. Supplied equipment must be rated and warranted to withstand and operate under these conditions.

2) All electrical components, including overcurrent protection, disconnect, surge suppression devices, conduit, wiring and terminals must have UL or equivalent listing and have appropriate voltage, current and temperature ratings for the application. Special attention should be given to appropriate ratings for components used in DC circuits.

3) All wiring shall be listed for a minimum operation of 600 volts and temperature rating of 90° C and be suitable for use in wet locations for portions of the system that are outside.

B. PV Array Modules:

1) The PV modules shall meet or exceed the requirements of Underwriter Laboratories (UL) Standard 1703 Standard for Safety for Flat-Plate Photovoltaic Modules and either IEEE Standard 1262-1995 IEEE Recommended Practice for Qualification of Photovoltaic (PV) Modules and Panels or IEC 1215 Crystalline Silicon Terrestrial Photovoltaic (PV) Modules- Design Qualification and Type Approval.

2) Each PV module shall include any required bypass diodes installed in the module junction box.

3) Each PV module shall be warranted by the manufacturer for at least 90% of its rated power for 10 years and 80% of its rated power for 20 years from the date of system acceptance.

4) The PV modules' electrical characteristics including current-voltage (I-V) curves and temperature coefficients of module power, voltage, and current shall be characterized by a research laboratory such as the Florida Solar Energy Center, the National Renewable Energy Laboratory, PowerMark Corporation, Sandia National Laboratories, or Arizona State University.

5) Array surface area must be limited due to mechanical and wind load constraints on the pole mounted arrays. For these reasons, higher efficiency modules are strongly desired to minimize array surface area requirements. The PV modules used in these systems must also meet industry-accepted standards for performance, reliability, safety and other considerations as outlined below:

6) Either crystalline or polycrystalline silicon flat-plate PV modules are required; thin-film PV modules are not acceptable for these applications due to their lower efficiencies and larger surface areas required.

7) Backing plates on the underside if the PV array may be provided for vandalism and damage protection, however, these apparatus should be designed as to not severely restrict air circulation beneath the array, and must not allow module temperatures to exceed 75 degrees C under an ambient temperature of 35 degrees C

C. Pole-Mounted Solar Tracker

1) The PV solar arrays shall be mounted on pole-mounted solar trackers that will orient the arrays for enhanced collection. The trackers may be single or dual axis. The trackers shall be compatible with the arrays and other array mounted hardware. The trackers shall not require or include batteries. The trackers shall provide:

2) Microprocessor control system

3) Automatic location and configuration

4) Self initialization upon daily power up

D. Power Conversion

1) The power conversion system (PCS) for the PV system shall be of the output voltage and phase shown on the drawings and shall be designed specifically for photovoltaic arrays and be capable of

automatic, continuous, and stable operation over the range of voltages, currents, and power levels for the size and type of array used.

2) The PCS shall be compliant with UL1741 (Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems). The PCS shall also comply with IEEE Std. 519 (Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems) and the latest applicable ANSI and FCC standards and addenda dated prior to the award of the purchase order for this procurement. Alternate specifications may be proposed to suit the proposed hardware.

3) If shown on the drawings the PCS must have an automatic visual indicator showing whether the system is on-line or not.

4) The PCS must have at least a two-year repair or replacement warranty from the manufacturer covering parts and labor.

5) The PCS, AC and DC disconnects and any other required electronics shall be installed near the array as shown on the drawings.

E. PV Array Mechanical Design

1) The Contractor shall provide the mechanical hardware for mounting the photovoltaic modules or arrays. The Contractor shall provide all other hardware required for assembling the photovoltaic modules and panels and structurally attaching them to the supporting lighting poles.

2) The PV array, including modules, hardware and attachments shall be designed to withstand wind loads of 130 mph or more and comply with all existing local and national codes. The PV supplier shall provide the solar hardware weight and wind load factors to the General Contractor so that the structural design of the supporting lighting poles can be made to properly support the PV equipment.

3) Array mounting hardware supplied by the bidder should be compatible with the site considerations and environment. Special attention should be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structure. Corrosion resistance and durability of the mechanical hardware shall be provided by the use of galvanized steel of the same grade as the existing roof and by the use of corrosion resistant fasteners throughout. Materials used shall ensure that no staining of the supporting lighting poles. Commercial-off-the-shelf mounting hardware designed for and compatible with the solar cell modules shall be used if available.

## 5 EXECUTION

A. All installation shall be as shown on the drawings.

B. Voltage drop in array DC source circuits should be limited to no more than five percent (5%), including losses in conductors and through all fuses blocking diodes and termination points.

C. All overcurrent devices shall have trip ratings no greater than the de-rated ampacity of the conductors that it protects.

D. All series connected strings of modules must include a series fuse as required by UL and NEC to prevent to wiring or other system components. Parallel connections of modules in individual source circuits are not permitted. Parallel-connected cells within individual modules are allowable as long as the module listing allows for the series fuse required for this configuration.

E. All series connected strings of modules (source circuits) also include a blocking diode to prevent reverse currents. These diodes should have low voltage drop to meet the requirements above, and have a voltage and current ratings (at temperature) at least twice the open-circuit voltage and short-circuit ratings of the source circuits.

F. All wiring shall be supported in accordance with the provisions of the National Electrical Code.

G. Every feeder in pull boxes and panel cabinets and branch circuits in outlet boxes and pull boxes having more than one circuit shall be tagged to show the name or number of the circuit.

H. Conduit and exposed cable runs shall be straight and true and be installed as shown on the drawings. Joints shall be set up tight. Elbows, offsets, and bends shall be symmetrical and uniform.

I. The successful Contractor shall have qualifications as a certified solar photovoltaic system installer as issued by a Canadian or United States industry association. In addition the lead installer personnel shall hold current certification by a recognized organization such as the North American Board of Certified Energy Practitioners (NABCEP).

J. Provide the following to show all vendor unique systems and equipment to be provided for the PV system:

1) Complete parts lists, including all electrical components, mechanical hardware and other equipment required for installing the systems (must include description and make for all the equipment provided, model/part number and source are also required for the PV modules and the inverter).

2) Shop drawings for array wiring and array structure

3) Complete PV system performance analysis considering proposed module performance with solar tracking and power conversion

4) Electrical schematics and diagrams for the DC circuits and AC circuits from micro-inverters to combiners.

5) Mechanical drawings showing details of module/array mechanical support.

## 6 SUBMISSION

A. Provide 6 copies of manufacturer's catalog cuts or shop drawings for the items listed below. Submittals shall include unit construction and ratings and shall include any recommendations by the installer or manufacturer. Submissions shall show that all units conform to the requirements herein.

1) PV Solar Array Modules

2) Pole mounted solar tracker

3) PV Power Conversion Devices

4) AC and DC disconnects

**END OF SECTION 263100**

# 265000 LIGHTING

## 1 GENERAL

The General Conditions and Supplementary Special Conditions of Division 1 and the General Provisions of Division 26 shall apply to all work under this Section of the specifications.

## 2 SCOPE

Provide all labor, materials, equipment, and services and perform all operations required for the complete installation of all lighting fixtures and related work as shown on the drawings and as specified herein.

## 3 MATERIALS

A. All lighting fixtures shall be listed by Underwriter's Laboratory, Inc. or the Electrical Testing Laboratories. All accessory equipment such as ballasts, starters, sockets, and lampholders shall be listed by Underwriter's Laboratory, Inc. or the Electrical Testing Laboratories.

B. Fluorescent lighting fixtures shall be provided with the proper type lamp and with energy efficient ballasts. All fluorescent lamps shall be rapid start and be General Electric, Westinghouse, Phillips, or Sylvania.

C. Parking lot lighting fixtures shall be light emitting diode (LED) type as shown on the drawings or approved alternate.

D. Parking lot lighting poles are also used for support of the solar photovoltaic arrays and shall be in accordance with the drawings and Section 263100.

## 4 EXECUTION

A. All devices shall be located generally as shown on the drawings.

B. All devices shall be installed plumb and level and shall be fitted tightly to the mounting surface.

C. Contractor shall provide all straps, supports, hangers, and other materials required for proper installation. Continuous rows of fixtures shall be installed so as to provide perfect alignment.

D. Parking lot fixture poles shall be supported on concrete bases with embedded anchor bolts of the sizes supplied with the pole.

## 5 SUBMISSION

Provide 6 copies of manufacturer's catalog cuts or shop drawings for the items listed below. Submittals shall include unit construction and ratings and shall include any recommendations by the installer or manufacturer. Submissions shall show that all units conform to the requirements herein.

Lighting fixtures
Site lighting poles

**END OF SECTION 265000**